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Enhanced Quality of Services in WiMAX Network using Scheduling Algorithm

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Abstract— In the past years, wireless communication is developed considerably. Also, like WiMAX network, broadband wireless networks are also taken into attention. In these networks, Quality of Services (QoS) is used for various Application support. These programs include internet telephone, multi-media services such as video broadcast, video conference and etc. Providing the quality of service is complex in a multi-service WiMAX environment as it data flow, traffic behaviors and quality requirements have different services. It is possible that a unique scheduling algorithm is not adequate due to the features of distinct quality of service of each service. Thus, selecting a suitable scheduling algorithm is important in providing the quality of service of these broadband wireless access networks. According to the previous approaches there are various scheduling algorithms, for example, First-In-First-Out (FIFO), Priority queue (PQ), Weight Fair Queuing (WFQ), Round Robin (RR), Deficit Round Robin (DRR), Modified Deficit Round Robin (MDRR), was done. The outcomes demonstrated that proper determination of scheduling algorithms can enhance the required quality of service for various activity sorts of users. The Haziea is the best scheduling algorithms in this assessment is resolved based on the base jitter, throughput and most extreme got activity for every servicing class and particular application.

Index Terms— Quality of Service (QoS), WiMax, IEEE 802.16e, Scheduling Algorithm, Haizea.

1 Introduction

WiMAX (Worldwide Interoperability for Microwave Access), a broadband wireless technology, developed by the WiMAX Forum is based on the 802.16 standard [1, 2].The popularity of wireless networks is widely recognized because of its strong support and ease of use in the end systems. Heterogeneous wireless networks are becoming of widespread use with Internet's real-time multimedia applications. Short range WLAN systems, as well as different cellular systems and WiMAX, provide some level of QoS and are needed to realize ubiquitous Internet services. But realtime multimedia applications, in particular interactive and live streaming applications, set strict requirements for the QoS. Some applications need relatively wide bandwidth; the bandwidth should be available in both directions constantly. Applications like voice and video need short transmission delay and jitter but they still have ability to tolerate some packet loss [1]. WiMAX is capable of reaching remote areas with high data rate transfer, mobility support and a native Quality of Service management (even if just limited to the wireless IEEE802.16 links) [2].

2 QoS Technical Challenges

The IEEE 802.16e [6] standard based Mobile WiMAX (Worldwide Interoperability for Microwave Access) system will be investigated for the purpose of Quality of Service provisioning. As a specialized test, radio asset administration will be essentially considered. Having as a top priority the expensive range and the undeniably all the more requesting applications with always developing number of supporters, principle thought of this theory have been given to profit by the decreased measure of range expended for the same number of clients. As a potential arrangement the booking calculations will be taken into primary thought and the present surely understood calculations will be quickly depicted. Inside the pool of booking calculations and with the end goal of accomplishing proficient radio asset administration, planning calculation's characteristics, properties and design will be concentrated on in subtle element. Upheld by the way that the standard does not underscore a particular planning calculation for surveying administrations, and after that a well thoroughly considered calculation will be of awesome commitment to the zone under scrutiny. For elucidation, Figure 1 is attracted to demonstrate the specialized difficulties joined by giving Quality of Service their comparing potential arrangement [3]. Note from Figure 1 that there are two other challenges to comprehensively provide QoS: Supporting multimedia (voice, data, video ... etc.) on a single access network and end-to-end quality of service.

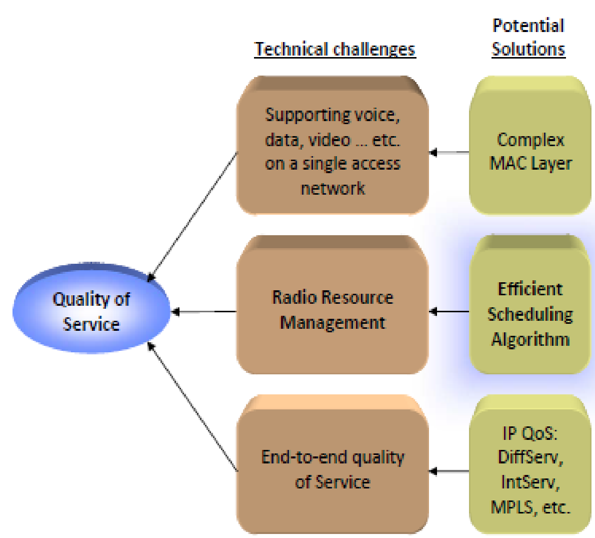

Figure 1: QoS Technical Challenges.

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3 IEEE 802.16E Amendment

The IEEE 802.16e standard amendment is commercially known as “Mobile WiMAX”. This is since the standard have included NLOS deployment version of WiMAX that enables the vehicular mobile operation; however, it does not mean that it is only applicable on mobiles, rather it supports both moving mobiles and fixed end user devices [3].

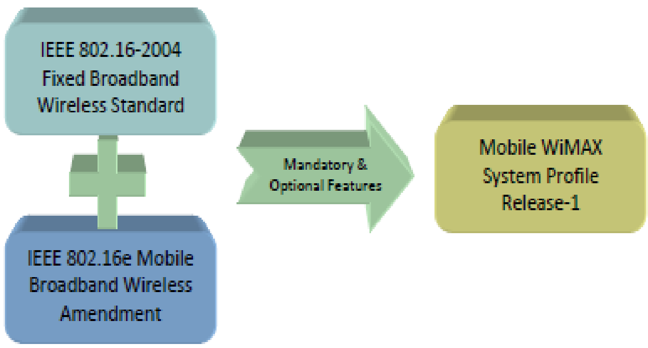

Figure 2: QoS Technical Challenges.

The determinations delivered consecutive through the advancement of the WiMAX standard must be tried for transforming them into an interoperable adaptation of the standard. In this way, the "WiMAX Forum" gathering was shaped in 2001 to approve conformance and interoperability between various merchant gadgets [9]. The discussion additionally characterizes the required and discretionary elements of the standard into "framework profiles" [10]. For example, the "Portable WiMAX System Profile Release-1" was framed by the blend of the IEEE 802.16e Mobile Broadband Wireless Amendment and IEEE 802.16-2004 Fixed Broadband Wireless Standard, as it is appeared in Figure 2. Since the postulation is thinking about the IEEE 802.16e (Mobile WiMAX) standard alteration as the examination host for the talked about booking calculations, in this way starting now and into the foreseeable future any specified innovation will be those which are substantial for the Mobile WiMAX. For example, the different access procedure considered will be Orthogonal Frequency Division Multiple Access (OFDMA) instead of the already used Orthogonal Frequency Division Multiplexing (OFDM) strategy. Since the bundle planning topic is basically done in the MAC layer of the OSI protocol stack, in this part the primary assignment will be to display a brief foundation outline on the booking technique related MAC elements; as it will likewise quickly clarify the WiMAX Physical (PHY) Layer inter-related functionalities which are included in the scheduling process.

4 Scheduling Algorithms

After Packet Switching (PS) systems appeared, need was perceived to separate between various sorts of bundles. From that point forward parcel planning has been a hot examination subject its as yet being researched at numerous foundations. This is basically because scheduling means bandwidth sharing [13]. Customarily, the First Come First Served (FCFS) plan had been utilized for bundle booking. Bundles originating from all the info connections were enqueued into a First in First out (FIFO) memory stack, and after that they were dequeued one by one on to the yield join. This is appeared in Figure 3. Since dissimilar to bundles were blended and treated similarly, parcels requiring pressing conveyance couldn't be accomplished. So there is no scheduling move making place for this situation.

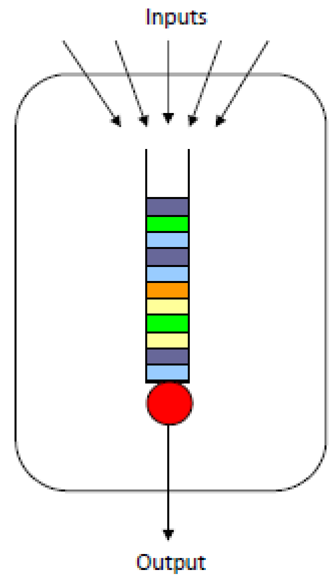

Figure 3: FCFS FIFO Stack.

In the present time diverse lines are indicated to non comparative bundles for accomplishing parcel grouping. For this situation booking ought to be finished. The fundamental assignment of the implanted scheduling algorithm is to pick the following parcel to be dequeued from the accessible multi lines and sent onto the yield join. This is outlined in Figure 4 demonstrated as follows

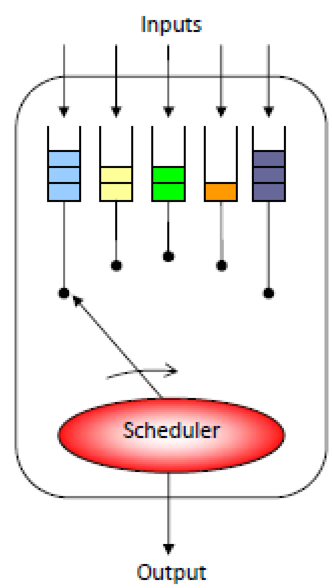

Figure 4: FCFS FIFO Stack.

5 Haizea

Haizea is an eminent cloud scheduler that offers high performance in terms of job turnaround time and job completion rate. However, Haizea, and cloud schedulers in general, suffer

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from low resource utilization. Additionally, cloud schedulers usually consider only end users demands, while providers' demands are entirely neglected. This is because an infinite pool of resources is assumed, which is difficult to achieve and simply not true in private clouds. Conversely, Condor, the eminent HTC scheduler, is known for addressing these shortcomings by formulating owner's and user's requirements as a logical expression evaluated based on the context which gives high resource utilization. Unfortunately, this comes with the price of long execution time. Therefore, the end objective of this work is to ensure better resource utilization in private clouds by combining the two well known schedulers, Haizea and Condor, to maximize their advantages and overcome their limitations. To do this, we adapted the Condor matchmaking policy to suit Haizea and implemented it along with additional functions to deal with Condor attributes for jobs and resources so that the new implementation of Haizea can address the additional requirements of owners and users. Additionally, we adapted the Condor matchmaking policy and introduced the additional jobs and resources attributes used by Condor to address resource owner and user requirements.

```
Input: Leases
Output: Schedule of resources and jobs
Description:
for every period or change point
    for each received lease
        if (lease.type is AR/immediate lease)
            search for required resources
            if (there are enough resources)
                if (the resources are running BE lease)
                    preempt the BE lease;
                    suspend BE lease;
                    queue BE lease ;
                schedule the AR/immediate lease on those resources;
            else
                reject the AR/immediate lease ;
        if (lease.type is BE lease)
            enqueue (lease);
    for each l ∈ LeaseQueue
        dequeue (l);
        for each m ∈ MachinePool
            if (m.ClassAd.Type == j.ClassAd.Requirements)
                machine_core+ = 0.5;
                Matched_list[]+ = m;
            else
                machine_core = 0;
        for each (m ∈ Matched_list[])
            m = MAX (Matched_list[], j.ClassAd.Rank);
            if (there is a job p running on m)
                if (j.ClassAd.Type == m.ClassAd.Rank
                and p.ClassAd.Type != m.ClassAd.Rank )
                    preempt p;
                    queue p;
                else
                    remove m from Matched_list[];
                        m = nil;
            if (m != nill)
                schedule m for j ;
                break ;
```

Figure 5: Haizea Scheduling Adjustment.

This involved applying the lease concept and types to the ClassAd of condor and implementing required interactions with the lease manager and mapped, as well as insuring compatible interface with other Haizea components, as shown in Figure 5.

6 SIMULATED RESULTS

In this section, the proposed algorithm is evaluated via computer simulation using MATLAB simulator. All simulation results are obtained on the basis of proposed approach Haizea as scheduling algorithm for throughput and range in WiMAX system. Figure 6 show the BER of received symbols according to number of users using Matlab.

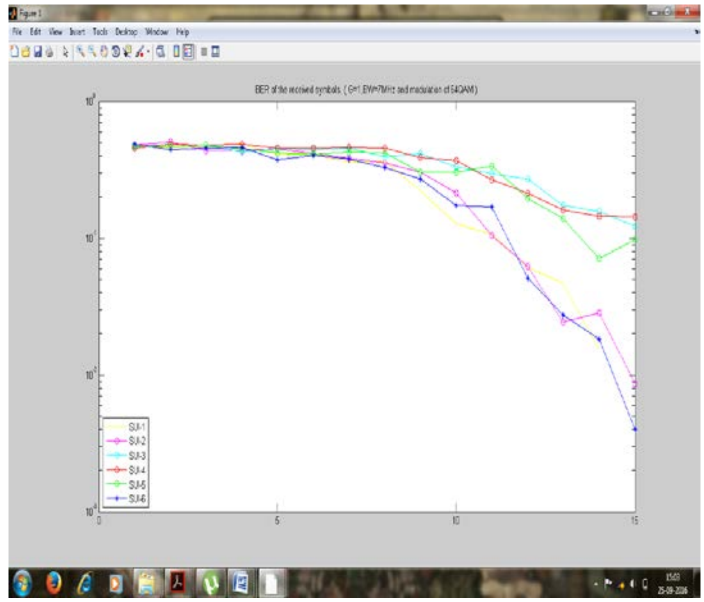

Figure 6: BER of Received Symbols.

As demonstrated in Figure 7, show packet delays for voice traffic in scenarios with traffic load. In comparative analysis shows the values of jitters for different scheduling algorithm with enabled network. It can be seen that as the network load increases, the jitter of the packets decreases: this is because when the network approaches saturation point the fluctuations of packet delays decrease.

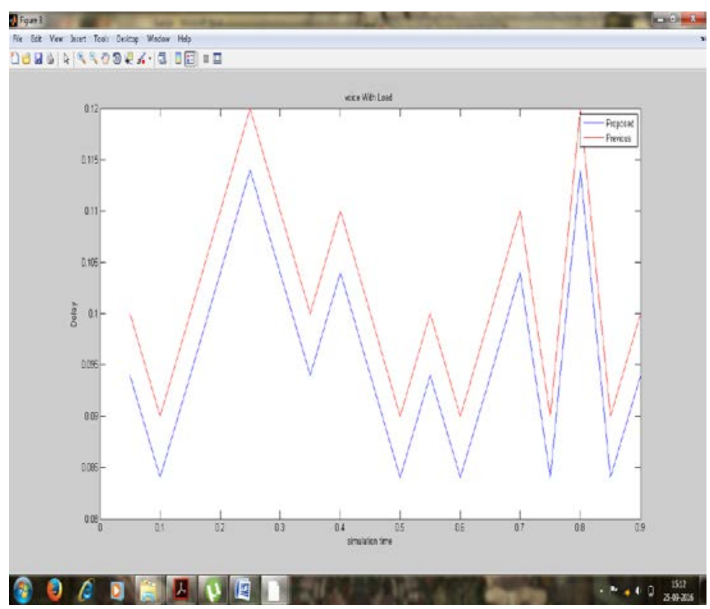

Figure 7: Voice with Load.

As demonstrated in Figure 8, show packet delays for video traffic in scenarios with traffic load. In comparative analysis shows the values of jitters for different scheduling algorithm

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with enabled network. It can be seen that as the network load increases, the jitter of the packets decreases: this is because when the network approaches saturation point the fluctuations of packet delays decrease.

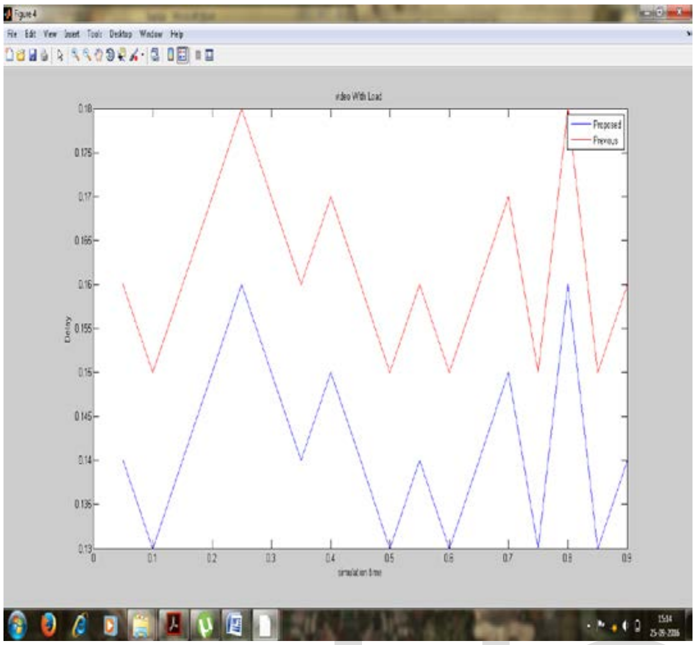

Figure 8: Video with Load.

As presented in Figure 9, indicates the mean end to end delay in video conference traffic. In this figure, proposed scheduling algorithms have the lowest delay and previous scheduling algorithm has the highest delay in this traffic.

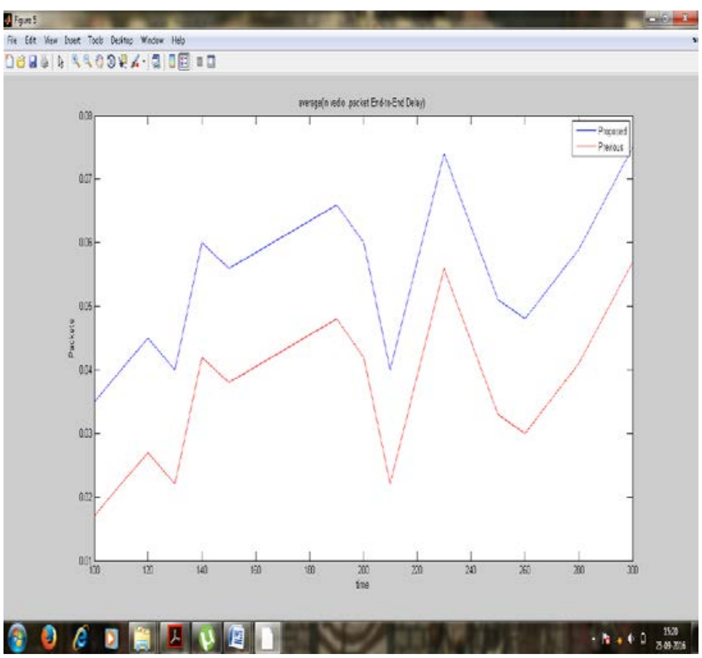

Figure 9: Average video conferencing packet end to end delay.

As presented in Figure 10, indicates the mean end to end delay in voice traffic. In this figure, proposed scheduling algorithms have the lowest delay and previous scheduling algorithm has the highest delay in this traffic.

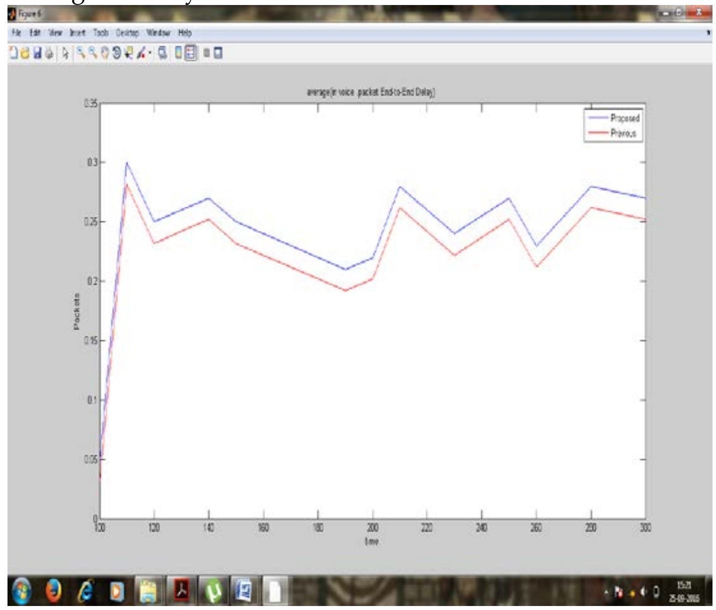

Figure 10: Average voice conferencing packet end to end delay.

As shown in Figure 11, indicates the mean jitter in voice traffic. In this figure, proposed scheduling algorithms have the highest jitter and previous scheduling algorithm has the lowest jitter in this traffic.

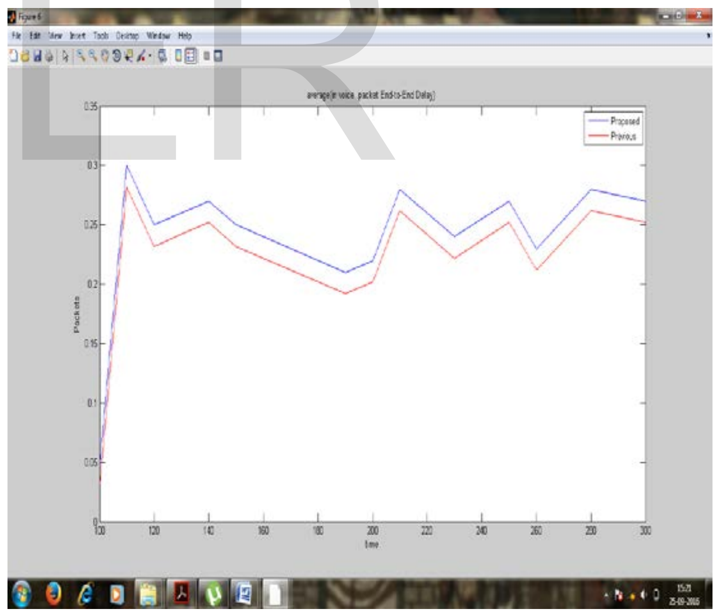

Figure 11: Average jitter in voice

7 Conclusion

Designing a scheduler that is less unpredictable, more efficient and gives a superior Quality of Service is of incredible significance to mobile WiMAX systems. In this dissertation, a comprehensive, yet brief, introduction was given for the IEEE 802.16e monetarily known as Mobile WiMAX Systems. Round Robin (RR) scheduling algorithm has been concentrated on inside and out. The Haizea scheduling algorithms gives better results on the base jitter, throughput and most extreme got activity for every servicing class and particular application. Further simulations must be done to guarantee that the scheduler is also able to provide the QoS requirements with a larger number of subscriber stations with respect to the QoS constraints that were achieved in this work. Furthermore, the proposed scheduler might be taken forward and applied on other distinctive systems. This will test the versatility of the algorithm to various situations.

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